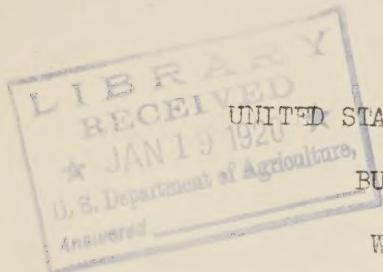


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UNITED STATES DEPARTMENT OF AGRICULTURE.

BUREAU OF ENTOMOLOGY

WASHINGTON, D.C.

Southern Field Crop  
Insect Investigations.

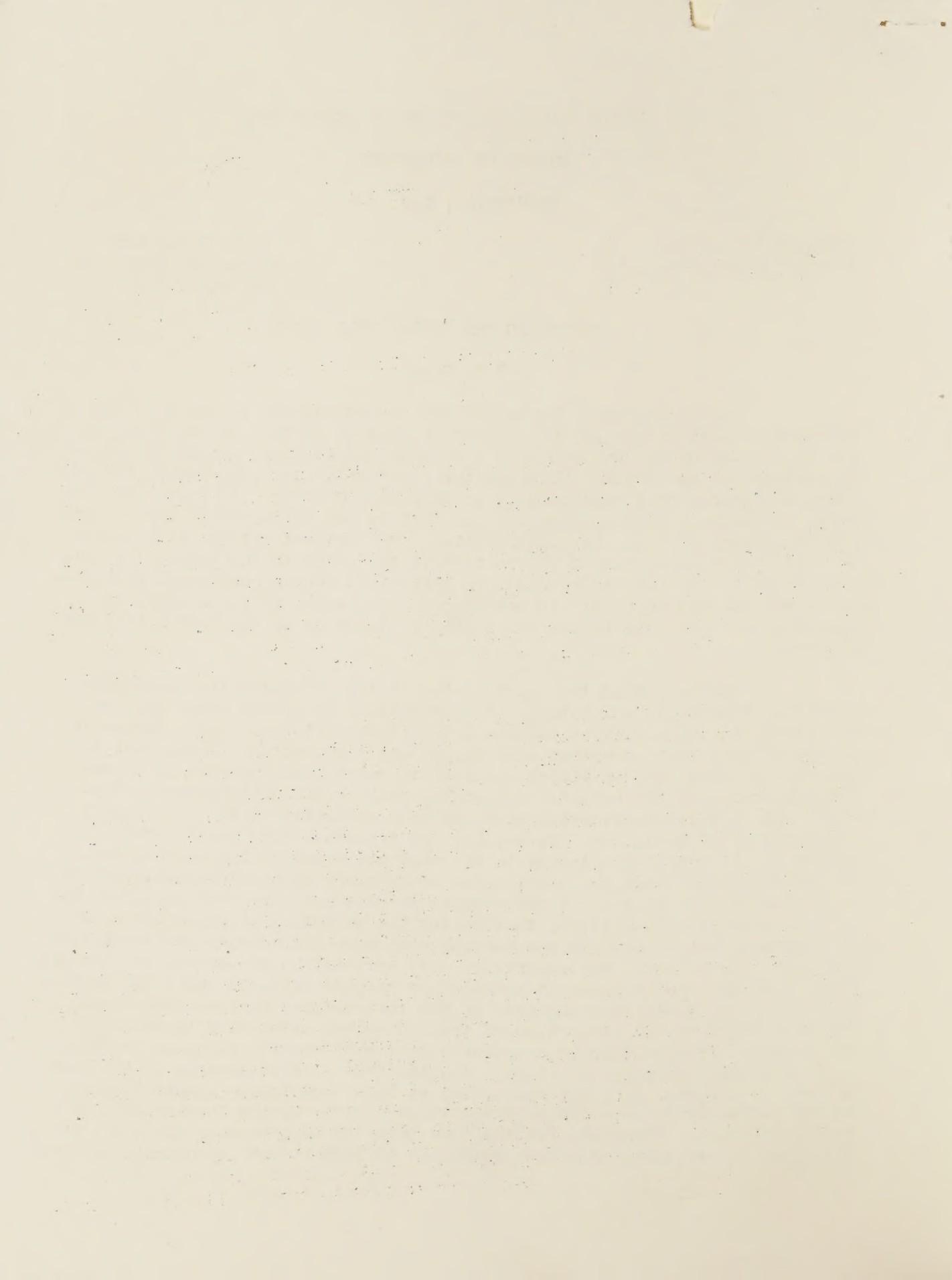
Delta Laboratory  
Tallulah, Louisiana,  
May 10, 1919.

### POISONING THE COTTON BOLL WEEVIL

By B.R. Coad.

During the past few months the investigations of the U. S. Department of Agriculture on the subject of control of the cotton boll weevil by the use of poisons has been receiving considerable publicity in many portions of the South. Unfortunately, authoritative information in the shape of Departmental publications is decidedly lacking. In fact, only one bulletin has been published so far and that is now considerably out of date and no longer available for distribution. The present article is prepared to assist in placing recent information in the hands of the interested cotton planters. So far, there has been just about enough commercial propaganda on the subject to result in considerable confusion of ideas among the planters and the majority are apparently in doubt as to the best method for procedure.

At the outset the exact status of the poisoning investigations should be thoroughly understood. Investigations have been under way for six years now and have been increased in extent each year, until during the season of 1918 they comprised some 35,000 acres of cotton. Throughout the majority of this area an effort was made to control the weevils on a commercial scale and the results were on the whole quite satisfactory. However, all of this experimental work has been conducted in the Mississippi Delta region of Louisiana, Mississippi and Arkansas, and, consequently, the experience is confined entirely to the conditions prevailing in this area. It has been found that the weevils can undoubtedly be poisoned successfully under certain conditions but the results secured are very much dependent upon very localized conditions, thus making the operation of poisoning a more or less complicated one and one varying very much indeed with different conditions. Furthermore, the experience with this method of control has not yet progressed to a point where it is possible to give definite rules for operation under all conditions and many of the instructions must be conditional and leave much to the discretion of the individual attempting to utilize the system. It must thus be remembered that boll weevil poisoning is still in a decidedly experimental stage. Judging from results secured in the past, it will be possible to adapt the method to local conditions almost anywhere in the Cotton Belt, once the experiments have been carried through along a series of years. However, for the time being it is generally advisable to "go slow" in utilizing this new system and to test it out experimentally first.



During a recent trip through a number of the interested districts the writer found a considerable number of planters who had already arranged to poison and had secured a supply of poison but who had not the slightest idea as to how they were going to conduct the operation. They had equipped themselves with machinery for applying the dust and were very hazy in their ideas as to when and how it should be used. This work is decidedly experimental as yet and for the present at least it behooves all who are going to try it to make every possible effort to place themselves on the safe side by doing it right as nearly as we can tell from the present information. The weevil injury is so exceedingly severe that with weevil control the margin of profit is quite large and justifies a considerable expenditure per acre. Consequently, it is absurdly foolish to attempt to economize on a few pounds of poison or a hand dust gun or two when this may mean not only a reduction in the profits, but the actual loss of the amount expended. It will probably be possible to work out much more simple methods and more economical ones in the future. The Department most strongly urges that any one wishing to poison should make up his mind to use the proper methods or simply to drop the idea of attempting the operation. Other methods than these recommended may possibly give successful results, but the chances are decidedly against them until they have been tested out on a small scale they should be avoided.

By far the best poison for weevil control which has been developed in this work so far is dry powdered calcium arsenate. This chemical is a decidedly new development as an insecticide and owing to the fact that there is a certain amount of difficulty attendant to its manufacture which may result in unsatisfactory material being made, the Department has consistently urged the farmers to purchase it on specifications. If "calcium arsenate" only is called for, the material furnished may be too low in arsenic content to poison the weevil successfully, or the soluble arsenic content may be so high that it will burn the plants, or its mechanical condition may be such that it cannot be successfully used as a dust. Consequently, every man buying calcium arsenate should require that it conform to the following specifications:

Not less than 40% Arsenic Pentoxide  
Not more " 0.75% Water Soluble Arsenic  
Pentoxide  
Density not less than 80 or more than 100  
cubic inches per pound.

A number of chemical companies are now manufacturing this material and a fair supply is available for distribution in the South. The following companies are probably the principal ones expecting to supply it during the coming season:

Riches, Piver & Co.  
Vicksburg, Miss.

Grasselli Chemical Co.,  
Godchaux Bldg.,  
New Orleans, La.

Sherwin-Williams Co.,  
#317 Camp Street,  
New Orleans, La.

General Chemical Co.,  
#25 Broad St, N.Y. City

Toledo Rex Spray Co.,  
Toledo, Ohio,

Corona Chemical Co.,  
Milwaukee, Wis.



It may also be purchased through many of the local seed houses or dealers in plantation supplies. However, owing to the fact that this is a decidedly new chemical on the market, it is especially desirable to watch very carefully the composition of the material sold this year in order to prevent the use of unsatisfactory or actually injurious material. Consequently, all purchases are urged to send samples immediately upon receipt to the Delta Laboratory, Tallulah, Louisiana, for analysis. These analyses will be furnished free of charge and as quickly as possible after receipt of the sample. Samples of one-half pound each should be taken from several different packages in each shipment and submitted separately.

If the material conforms to the specifications quoted above, it is absolutely impossible to burn the cotton plants with it. It may be applied in unlimited quantities daily with no danger whatever to the cotton plants.

Another question which frequently arises is whether or not this material will control the cotton leaf worm. It undoubtedly will be fully as satisfactory for this purpose as Paris Green or any other chemical which has been utilized so far and has the decided advantage of being cheaper than Paris Green and less injurious to the plants.

The effect of this material on both man and animal should also be considered. It is not nearly as dangerous in this connection as Paris Green as it does not have the caustic action characteristic of Paris Green. However, it should be remembered that there is a certain amount of danger attendant upon the use of any arsenical. Reasonable precautions should be taken to protect both men and animals associated with it. Inhaling the dust should be avoided as far as possible. Probably the most important precaution is that of personal cleanliness when using the material. All field hands should be forced to bathe as soon as they complete an application of it, and they should not be permitted to eat anything without at least washing their hands and faces thoroughly. No injury to stock has ever been experienced while engaged on the work, but it is probably best to plan to use muzzles on the animals working poisoned fields.

Many farmers are accustomed to using lime or some similar chemical with Paris Green which they have been using for leaf worm control and anticipate following this method in using the calcium arsenate for the control of weevil. In the first place it should be remembered that the primary reason for using lime with Paris Green is to dilute it and reduce the chance of burning the cotton. As has been mentioned calcium arsenate will not burn the cotton and thus there is no necessity for adding a carrier. Furthermore, it is very difficult to secure a satisfactory mixture of calcium arsenate and practically any carrier. It requires a machine mixing to get them thoroughly united and even then it is frequently found that unless they are of exactly the same density the two chemicals will separate very rapidly on shaking and the result is that the farmer will be putting out pure lime for a few minutes and then arsenic. To control the weevil satisfactorily requires a certain



amount of calcium arsenate per acre and if a carrier is added this merely necessitates increasing the amount of dust which it will be necessary to distribute on an acre of cotton, thus correspondingly increasing all handling charges and cost of packages, etc. Furthermore, if a diluent is used there is considerable danger of too much reduction in the amount of arsenic used per acre, and thus the success of the operation is imperiled. For these reasons it is not advisable to utilize a carrier. There has also been a certain amount of agitation of using special mixtures, particularly mixtures of calcium arsenate and sulphur or some similar material. They should by all means be avoided for the present. There is not a single thing to recommend any mixture of this sort which has been developed so far and in fact all of the evidence is decidedly against them as they do nothing but increase the cost of operation and endanger its success. Consequently, farmers are urged to avoid all chemicals except straight calcium arsenate conforming to the specifications given. This also applies to old stand-bys such as Paris Green. A number of farmers are familiar with Paris Green, having utilized it in the control of the leaf worm and other insects in past years and in fact some of them already have supplies of this material on hand. It will undoubtedly exert a certain degree of weevil control, but on the other hand it has never proven at all satisfactory and the chances are decidedly against successful results from the use of this material.

The amount of poison required to treat an acre of cotton is a very important point. It has come to the attention of the writer that many planters have been informed that two or three pounds per acre will be satisfactory for a single treatment. It will not do for them to proceed on this basis as it will be found that this amount of material simply cannot be satisfactorily distributed over an acre of cotton. Of course, the primary point to consider in the application is absolute thoroughness of dusting. Every particle of the cotton plant should be covered with the exceedingly fine powder, and in gauging their applications the farmers should pay more attention to satisfying themselves that they are accomplishing this than to the exact poundage required. However, they will find that they positively cannot give a satisfactory application with the machinery now available with an average of less than five pounds per acre per application, and no man should expect to go over an acre with less material than this. In fact, he is going to find it takes considerable care to dust the cotton thoroughly and still not use more than this amount to the acre. Consequently, every man planning to poison should provide himself <sup>with</sup> five pounds for every application he is going to give.

The number of applications required for the season is quite an important point but one upon which it is very difficult to give generalized advice. In the first place, this depends entirely upon the type of place upon which the operation is conducted. For example, in the Mississippi Delta where the majority of experiments have been conducted in the past, the average plantation contains some 500 or more acres of cotton in one organization and it is usually found that on emerging from hibernation in the spring the weevils distribute themselves very unevenly over this area. This results in more or less of a concentration of weevils on fields immediately adjoining the most favorable hibernation quarters and



under such conditions the best method of control is to concentrate the poisoning on these most heavily infested cuts, -thus not only benefitting them but protecting the remainder of the cotton by preventing weevil migration later in the season. Under such conditions it will undoubtedly be necessary to give the highest cuts five or six treatments and from this number of applications will decrease on the more lightly infested cuts until those most distant from hibernation quarters will probably not require any treatment whatever. On the average small farm, however, the problem of poisoning is an entirely different one. Here, generally speaking, the area is so small that it is impracticable to select the most heavily infested spots and treat them. In fact, it has often been found that the weevils are rather generally distributed over the entire acreage. The exact number of applications necessary depends entirely upon local and seasonal conditions but for the present it is best to plan to utilize about four applications. It may prove necessary to use more than this or it may be found that a smaller number will suffice, but in stocking with the material for the season, the farmers should provide sufficient for at least four applications. In other words, every small farmer who is going to poison should have available at least twenty pounds of poison for every acre of cotton he intends to treat. The majority of the men who have arranged to poison so far have apparently not secured anything near this amount. In such cases the writer would decidedly advise that either plans be made to poison only a portion of the acreage projected or that additional material be secured immediately. The supply of poison for the coming season is undoubtedly going to be somewhat limited and its distribution is also not going to be satisfactory. Consequently, farmers cannot expect to start the operation with the present supply and then secure more on short notice when they need it as the probabilities are that they will not be able to secure it in mid-season. The effect of the poison generally speaking has been rather accumulative, that is, the first application or two simply develop conditions to the point where it takes the later applications to secure the real benefit of the operation. Furthermore, the application of this last poison is decidedly an emergency proposition and if delayed at all at the proper time the situation may easily get out of hand. All farmers who are going to poison are most strongly urged to decide on the exact acreage they are going to treat and to take immediate steps to provide themselves with at least twenty pounds of poison for each acre of cotton.

Surprising to say, it has apparently been the general tendency of men planning to poison to arrange for a supply of the calcium arsenate as soon as they decide to try it and to pay very little attention to the question of securing an adequate supply of suitable machinery. In reality, the supply of dusting machinery is undoubtedly going to be the limiting factor in boll weevil poisoning during the season of 1919, as there is not nearly enough available to utilize the amount of poison which it is possible to secure at this time. Consequently, no man should make arrangements for securing the poison until he first finds that he can secure dusting machinery for applying it.

So far, two types of dusting machinery have been developed. These are the large power dusters and the small hand dusters. These may be secured from the following companies:



Dust Sprayer Mfg. Co., Springfield Dry Powier Niagara Sprayer Co.,  
1822-4 West 9th St., Spray Co., Middleport, N.Y.  
Kansas City Mo., Springfield, Tenn.

Unfortunately an intermediate machine has not been developed as yet and such a machine is especially needed on properties ranging in acreage from forty to two hundred acres. The large power machines are so expensive that a man with less than two hundred acres in cotton can hardly afford to purchase one, while the small hand guns are so limited in capacity that it is very difficult to use them on an acreage totaling over forty or fifty acres. However, these two extremes are the only machinery available just now and it is necessary for the farmers to do as best they can with them. An intermediate machine operated by wheel traction which will sell for something in the neighborhood of \$75,000 and which will cover about twenty acres per day is now in the course of construction at the Delta Laboratory and undoubtedly a satisfactory machine of this type will be on the market for the cotton growing season of 1920.

The power duster is a horse-drawn, motor-operated machine, blowing dust from five nozzles, spaced four and a half feet apart. Thus the nozzles cover approximately five rows. However, the fog of dust created by this machine is generally sufficient to cover two more rows. Consequently, as a general thing it is best to plan to take seven rows at a trip with the machine, although in case the cotton is very dry and there is a wind blowing better results will be secured by reducing the feed slightly and taking only five rows at a time. This machine will probably cover about six or seven acres an hour, although this, of course depends upon the exact nature of the land being treated. It is probable that no more than ten hours of operation can be averaged per day. This of course means about 60 to 70 acres per day per machine and is as much as can be safely counted upon at the present time. Owing to the necessity of repeated applications which will be discussed a little later the acreage allotted to one of these machines should be limited to an amount which it can safely cover every week. Owing to interruptions due to bad weather conditions, etc., which are bound to occur, daily operation cannot be anticipated and the best allotment of acreage for one of these machines is probably about three hundred to three hundred and fifty acres. A slightly larger acreage may be handled by a single machine, but it is very dangerous to risk this as delays in operation would easily mean that the situation would get beyond control.

Several satisfactory models of hand guns are now on the market and may be purchased for about \$15.00 each. Five acres is about the maximum which can be expected from one of these machines in a single day. Furthermore, these machines are subject to frequent breakage and similar delays which cause considerable loss of time in their operation and it is best to have one of these machines for every fifteen acres of cotton to be treated by them. Theoretically, this would of course mean sufficient guns to treat the cotton acreage every three days, but it will be found in actual practice that so much time is lost that this allot-



ment of machines is not excessive. These machines take only one row at a time. There are some machines on the market advertised to treat two rows at a time, but so far these have not proven satisfactory and it is not advisable to attempt to use them just now.

All of these machines are provided with some feeding device so that they can be very easily regulated to put out either a large or small quantity of dust and this regulation should be very carefully attended to in order to secure a thorough dusting of the plants without any unnecessary waste of poison. As has been stated the point to be borne in mind is that it is desirable to get every particle of the cotton plant thoroughly covered with the fine particles of dust.

A considerable number of farmers have been planning to use the old method of poisoning for leaf worm popularly known as the "pole and bag" method in which the poison is simply placed in a cloth sack and shaken over the cotton plants. This is satisfactory in using Paris Green for the leaf worm, but will not do for boll weevil control. Calcium arsenate is of such a nature that it is almost impossible to secure a cloth through which it will dust at all. Furthermore, a very haphazard distribution of the poison is secured from this method of dusting and only a comparatively small proportion of the cotton plant is covered. This is sufficient in the case of an insect like the leaf worm which eats a considerable amount of tissue, but the success of boll weevil control depends entirely upon the absolute thoroughness of dusting which simply increases the percentage of weevils killed and any failure to secure this thorough dusting will result in such a reduction in the weevils killed that the benefit will quite probably be lost. Consequently, every one is advised most strongly against wasting their calcium arsenate by attempting to apply it with a bag and pole for boll weevil control.

Questions frequently have been asked concerning the efficacy of this material when applied as a liquid spray. A number of farmers are already equipped with spraying machines purchased for other work and would like to utilize these if possible. Here again, however, the effect is almost entirely lost as in only a few instances has it proven possible to secure a profit from applying the poison as a spray. Generally speaking, it is of little or no value when applied in this manner and it should be used only as a dry dust.

The time of day of operation is a very important question and at the outset it should be understood that the only point to consider in this connection is that of the weather conditions existing. It is extremely desirable to conduct all poisoning operations when the air is calm and when the plants are moist. Generally speaking these conditions are experienced only at night and in the early morning before the dew is dried from the plants. Consequently, the poisoning should be conducted during this period as far as possible. The power machines are equipped with lighting apparatus which permits their operation during the entire night and probably the best method of handling the hand gun situation will be to poison in the late evening and early morning. In case of emergency successful results can often be secured by applications when the plants are dry and there is a breeze but considerably more poison is

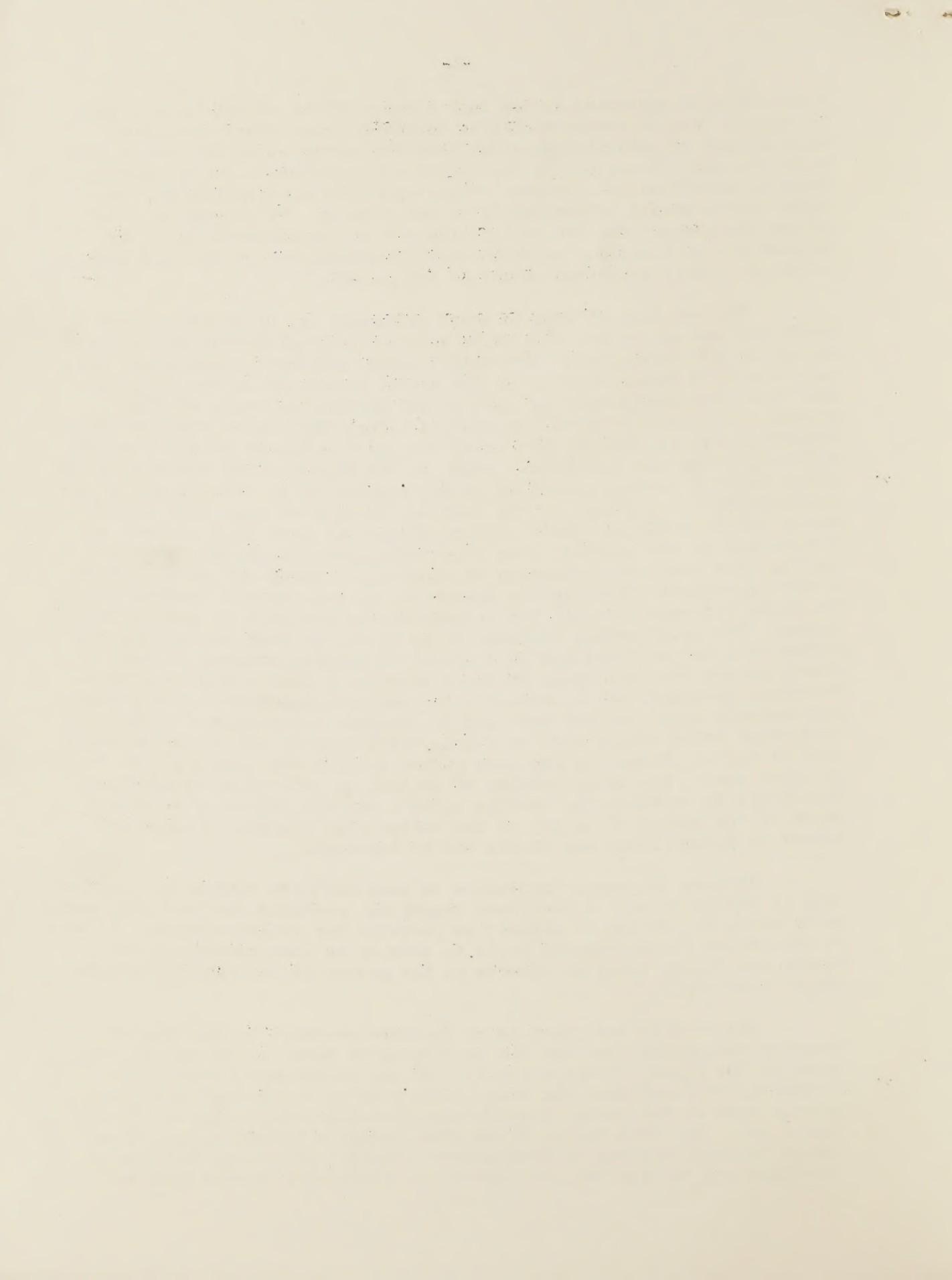


required in an operation during such a time and the effect is so greatly reduced that poisoning should be conducted under these conditions only in case of absolute emergency when the weevil situation has become quite serious. Occasionally dry nights are experienced during which there is more or less of a breeze. Whenever possible, operation during these nights should be avoided as in the daytime. Of course, in selecting the proper time for application the one desideratum is to try to make all applications possible when the plants are in the best condition to retain a maximum amount of the poison.

The question of when to start poisoning is, of course, a very important one and is one upon which only conditional advice can be given, as it will undoubtedly vary widely under different conditions. This time should be based entirely on the weevil abundance in the field rather than upon any particular date or any particular stage of plant growth. No poisoning should be started before the plants start to square briskly and it is best to wait until the weevils become fairly abundant before starting the treatment. Owing to the high natural shedding of the cotton plant a certain amount of square puncturing by weevils can be permitted without any danger to the crop as the squares shed from plants due to this puncturing simply replace those that were shed any way in the absence of the weevils. For this reason practically all work so far has been based on percentage of squares punctured and as this gives a very convenient criterion for measuring the boll weevil abundance in the field, it would be well for as many men as possible to utilize this system. The usual method followed is to go to the four corners and the center of a cotton field and to examine two hundred squares at each point, noting the percentage of these which have been weevil punctured. Generally speaking, it is advisable to start poisoning when this percentage reaches about ten per cent and to continue often enough to keep the percentage below twenty-five or thirty until late in the season at which time it may be allowed to run much higher without any injury to the crop. In other words, the whole problem of control is not one of eradication, but simply to restrain the weevils below a certain degree of abundance which is the degree of injury to the cotton crop itself. Eradication cannot be accomplished and should not be expected.

In case it proves impossible to make definite counts for percentage of weevil injury as have been suggested, probably the best plan would be to watch the fields as closely as possible for fallen squares. As soon as the yellow flared squares begin to show up in some numbers on the plants and fallen infested squares on the ground it is probably best to start poisoning.

The size of the plant is of no index whatever to the time of starting the application and the only thing to watch is the weevil abundance in the field. Where a field is of any considerable size it will frequently be found that the weevils emerging in the spring concentrate more or less on the cotton immediately adjoining brush and along ditch banks, etc. For this reason it is often possible to confine the first one or two applications to this heavier infested area along the edge of the field and to skip the portions of the field more distant from the



sources of infestation. Later in the season as the weevils increase it may be necessary to cover the entire field. However, in the case of the small fields it is undoubtedly best to go ahead and poison the entire area rather than attempt to economize by limiting the area treated.

The time interval between applications will depend upon many conditions, but generally speaking it will probably be best to plan to treat about once a week. In fact, it may be advisable to use a shorter interval in extreme cases while in other cases where effective control has been secured earlier a longer time interval can be utilized. The poison persists on the plants for a week or more, but it will be found that there is so much new growth produced every week and thus affording unpoisoned tissue for the weevils that it is best to repeat the application at the weekly interval regardless of weather conditions. The effect of rain on the applications has generally been of comparatively minor importance. In fact an occasional rain greatly increases the efficacy of the treatment. So far the rule has been followed that in case the treatment has been applied under satisfactory conditions and stands twenty-four hours without a heavy rain, this treatment will not require repeating under the usual interval. However, in case of a heavy drenching rain within twenty-four hours after the treatment, it is undoubtedly advisable to repeat this immediately.

The writer has frequently been asked questions about just exactly what gains in production may be expected from this treatment. This is something which it is absolutely impossible to prophesy, owing to the wide variation of weevil injury from field to field. It should always be remembered that the best which can be expected of the poisoning operation is the reduction of weevil injury to the crop. Poisoning cotton will not make cotton. It is necessary for the farmer and the land to do this and no one should be so foolish as to poison his cotton and then neglect its proper cultivation with an expectation of producing a satisfactory crop on account of the poisoning. In fact poisoning the crop merely provides an incentive for better and more thorough culture as it affords an opportunity for securing a larger crop. If properly handled an increase of one hundred pounds of seed cotton per acre at the present prices will pay for the operation and any increase secured above that amount will be clear profit.

Much of the information and advice given in this article is undoubtedly very conditional but it is about as definite as can be prepared in the present status of information on this subject. However, all planters planning to poison are urged to communicate with the Delta Laboratory, Tallulah, Louisiana, describing their local conditions and the most specific advice possible will be furnished them.

